

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 09 December 1999 (09.12.99)	
International application No. PCT/FI99/00258	Applicant's or agent's file reference 980713
International filing date (day/month/year) 29 March 1999 (29.03.99)	Priority date (day/month/year) 30 March 1998 (30.03.98)
Applicant VILO, Jaakko	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
22 October 1999 (22.10.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer C. Cupello Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 980713 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI99/00258	International filing date (day/month/year) 29.03.1999	Priority date (day/month/year) 30.03.1998
International Patent Classification (IPC) or national classification and IPC ⁷ B01D 33/76		
Applicant Outokumpu Oyj et al		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>2</u> sheets.</p>
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>

Date of submission of the demand 22.10.1999	Date of completion of this report 17.07.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Jan Carlerud/MP Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT /

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☐ the international application as originally filed.

☒ the description, pages 1-7, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____,
 pages _____, filed with the letter of _____.

☒ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. 1-7, filed with the letter of 18.05.2000,
 Nos. _____, filed with the letter of _____.

☒ the drawings, sheets/fig 1-4, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig _____, filed with the letter of _____,
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00258

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-7</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-7</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-7</u>	YES
	Claims		NO

2. Citations and explanations

Documents cited in the International Search Report:

- A) US 5362403 A
- B) DE 4425451 A1
- C) US 4695381 A

The present invention according to the amended claims relates to an apparatus for removing filtered material from a pressurised filter space. To enable removing of filtered material from the filter with maintained pressure a valve is provided at the outlet. Prior art valves for this purpose have several drawbacks, and the object of the invention is to eliminate some of these and to achieve an improved apparatus with a simpler structure.

A filter apparatus with means for removing material from a pressurised space with maintained pressure is known from document A. The apparatus is provided with a vertical discharge shaft with a hydraulically controlled closure means at the bottom end. The closure means comprises a conical locking member, which is moved up and down to close and open the discharge shaft. There is also a sensing means for sensing the height of the filter cake within the discharge shaft. The closure means is opened for a period in response to sensing a selected height of filter cake in the discharge shaft.

The apparatus according to the present invention, as specified in the amended claims, is different from the prior art apparatus with regard to the closure means. This comprises at least two axially mounted adjusting elements provided with ports and movable in relation to each other. Therefore, the subject matter of claim 1 is novel.

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00258

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

In view of what is disclosed in document A and in documents B-C, which are cited as further examples of prior art, the invention cannot be considered obvious to a person skilled in the art. Furthermore, it is considered to be industrially applicable.

CLAIMS

1. An apparatus for removing filtered material from a pressurised filter space, in which filter space there are installed members for feeding the material to be
5 processed into filtering that takes place in a pressurised space, as well as members for removing the filtering product, i.e. the filtered material, from the pressurised filter space, **characterised** in that in the discharge conduit (3,21) of the filter space, at the material discharge end, there is connected an adjusting member (4,27), said adjusting member (4,27) comprising at least two adjusting
10 elements (5,6;29,30) which are installed concentrically (8,31) in relation to each other and are provided with ports (7,33) and are movable in relation to each other, for maintaining the measurable surface height (11,28) of the filtered material contained in the discharge conduit (3,21) essentially at a predetermined value in a substantially continuous fashion.

15

2. An apparatus according to claim 1, **characterised** in that at least one of the adjusting elements (6,30) is installed movably around the axis (8,31).

3. An apparatus according to the claims 1 or 2, **characterised** in that in order to
20 measure the surface height (11) of the filtered material, the discharge conduit (3) is provided with an ultrasonic sensor (10).

4. An apparatus according to the claims 1 or 2, **characterised** in that in order to measure the surface height (28) of the filtered material, in the discharge conduit
25 (21) there is installed an actuator that measures the changes in the discharge conduit supporting structure (22).

5. An apparatus according to claim 4, **characterised** in that the actuator measuring the change of the discharge conduit supporting structure (22) is a
30 force measuring sensor (25).

2000-05-18

6. An apparatus according to claim 4, **characterised** in that the actuator measuring the change of the discharge conduit supporting structure (22) is a tension measuring sensor.
- 5 7. An apparatus according to any of the preceding claims, **characterised** in that the measuring of the filtered material surface height (10,25) and the member (15,31) for moving the adjusting element are interconnected electrically (12,26).

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum)

980713

Box No. I TITLE OF INVENTION

Apparatus for removing material from pressurised space

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Outokumpu Oyj
Riihitontuntie 7
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Finland

☐ This person is also inventor.

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Teleprinter No.

State (that is, country) of nationality:

Finland

State (that is, country) of residence:

Finland

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Vilo, Jaakko
Tammispalkantie 35
FIN-20300 Turku

Finland

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

Finland

State (that is, country) of residence:

Finland

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

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Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☐ **AP** ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☐ **EA** Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ **OA** OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input type="checkbox"/> AL Albania | <input type="checkbox"/> LS Lesotho |
| <input type="checkbox"/> AM Armenia | <input type="checkbox"/> LT Lithuania |
| <input type="checkbox"/> AT Austria | <input type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input type="checkbox"/> LV Latvia |
| <input type="checkbox"/> AZ Azerbaijan | <input type="checkbox"/> MD Republic of Moldova |
| <input type="checkbox"/> BA Bosnia and Herzegovina | <input type="checkbox"/> MG Madagascar |
| <input type="checkbox"/> BB Barbados | <input type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input type="checkbox"/> BG Bulgaria | <input type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BR Brazil | <input type="checkbox"/> MW Malawi |
| <input type="checkbox"/> BY Belarus | <input type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CA Canada | <input type="checkbox"/> NO Norway |
| <input type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CN China | <input type="checkbox"/> PL Poland |
| <input type="checkbox"/> CU Cuba | <input type="checkbox"/> PT Portugal |
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| <input type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RU Russian Federation |
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| <input type="checkbox"/> EE Estonia | <input type="checkbox"/> SE Sweden |
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| <input type="checkbox"/> FI Finland | <input type="checkbox"/> SI Slovenia |
| <input type="checkbox"/> GB United Kingdom | <input type="checkbox"/> SK Slovakia |
| <input type="checkbox"/> GD Grenada | <input type="checkbox"/> SL Sierra Leone |
| <input type="checkbox"/> GE Georgia | <input type="checkbox"/> TJ Tajikistan |
| <input type="checkbox"/> GH Ghana | <input type="checkbox"/> TM Turkmenistan |
| <input type="checkbox"/> GM Gambia | <input type="checkbox"/> TR Turkey |
| <input type="checkbox"/> HR Croatia | <input type="checkbox"/> TT Trinidad and Tobago |
| <input type="checkbox"/> HU Hungary | <input type="checkbox"/> UA Ukraine |
| <input type="checkbox"/> ID Indonesia | <input type="checkbox"/> UG Uganda |
| <input type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input type="checkbox"/> IN India | <input type="checkbox"/> UZ Uzbekistan |
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| <input checked="" type="checkbox"/> JP Japan | <input type="checkbox"/> YU Yugoslavia |
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Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ **ZA** Republic of South Africa
- ☐
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

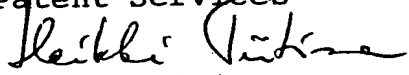
Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application:* regional Office	international application: receiving Office
item (1) 30 March 1998 (30.03.98)	980713	Finland		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 1

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY			
Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):		Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):	
ISA / SE		Date (day/month/year)	Number Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING	
This international application contains the following number of sheets: request : 3 description (excluding sequence listing part) : 7 claims : 2 abstract : 1 drawings : 3 sequence listing part of description : Total number of sheets : 16	This international application is accompanied by the item(s) marked below: 1. <input type="checkbox"/> fee calculation sheet 2. <input checked="" type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input checked="" type="checkbox"/> other (specify): Official Action
Figure of the drawings which should accompany the abstract: <u>1</u>	Language of filing of the international application: <u>English</u>

Box No. IX SIGNATURE OF APPLICANT OR AGENT	
<i>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</i>	
OUTOKUMPU OYJ Patent Services  Heikki Tiitinen	

For receiving Office use only		2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): <u>ISA /</u>	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	

Form PCT/RO/101 (last sheet) (July 1998; reprint January 1999) See Notes to the request form

PATENT COOPERATION TREATY

WO 99/49951
PCT/FI99/00258

PCT

From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

OUTOKUMPU OYJ
Patent Services
P.O. Box 27
FIN-02201 Espoo
FINLANDE

Hanna
5. 10. 99

Date of mailing (day/month/year)

07 October 1999 (07.10.99)

Applicant's or agent's file reference

980713

IMPORTANT NOTICE

International application No.

PCT/FI99/00258

International filing date (day/month/year)

29 March 1999 (29.03.99)

Priority date (day/month/year)

30 March 1998 (30.03.98)

Applicant

OUTOKUMPU OYJ et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,CN,EP,JP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

BR,CA,RU,ZA

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 07 October 1999 (07.10.99) under No. WO 99/49951

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

J. Zahra

Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.83.38



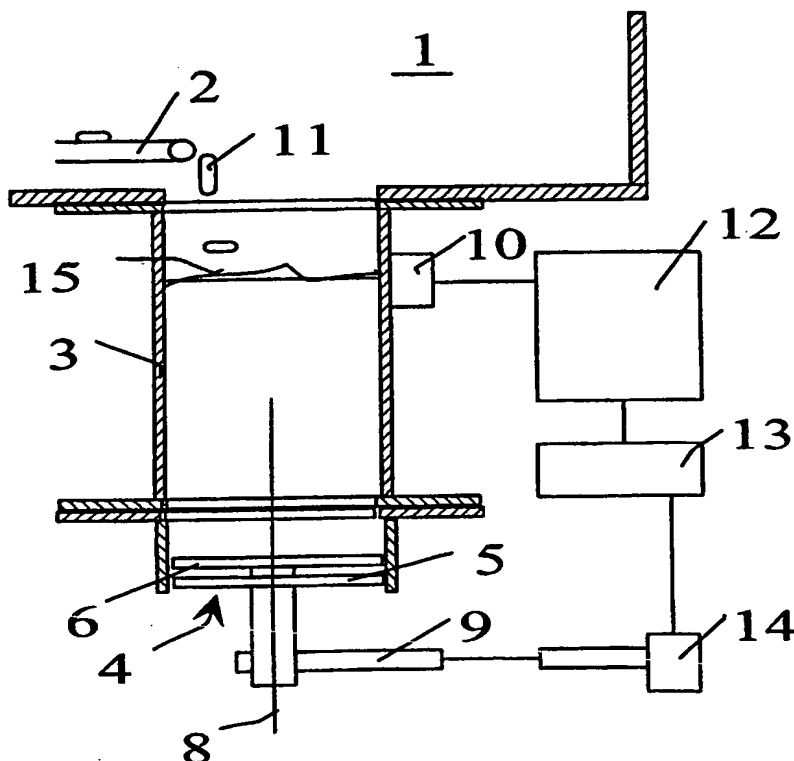
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B01D 33/76	A1	(11) International Publication Number: WO 99/49951 (43) International Publication Date: 7 October 1999 (07.10.99)
(21) International Application Number: PCT/FI99/00258 (22) International Filing Date: 29 March 1999 (29.03.99) (30) Priority Data: 980713 ✓ 30 March 1998 (30.03.98) FI (71) Applicant (for all designated States except US): OUTOKUMPU OYJ [FI/FI]; Riihitontuntie 7, FIN-02200 Espoo (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): VILO, Jaakko [FI/FI]; Tammispalantie 35, FIN-20300 Turku (FI). (74) Agent: OUTOKUMPU OYJ; Patent Services, P.O. Box 27, FIN-02201 Espoo (FI).		(81) Designated States: AU, BR, CA, CN, JP, KR, RU, US, ZA, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: APPARATUS FOR REMOVING MATERIAL FROM A PRESSURISED FILTER

(57) Abstract

The invention relates to an apparatus for removing filtered material from a pressurised filter space, in which filter space there are installed members for feeding the material to be processed to filtering carried out in a pressurised space, as well as members for removing the product, i.e. the filtered material created in the process, from the pressurised filter space. According to the invention, in the material discharge end of the discharge conduit (3, 21) of the filtering space, there is connected an adjusting member (4, 27), said adjusting member (4, 27) comprising at least two adjusting elements (5, 6; 29, 30) which are provided with ports (7, 33) and are movable in relation to each other, in order to maintain the measurable filtered material surface height (11, 28) in the discharge conduit (3, 21) essentially at a predetermined value in a substantially continuous fashion.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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CM	Cameroon		Republic of Korea	PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

APPARATUS FOR REMOVING MATERIAL FROM A PRESSURISED FILTER

The present invention relates to an apparatus for removing solid materials, and particularly to an apparatus for removing finely divided solids from a pressurised space to which there are connected members for feeding the material to be treated into a process taking place in a pressurised space and for removing the created products from said pressurised space.

From a pressurised space, material is usually removed so that the pressure in said space is reduced, and the material outlet is opened for removing the material from the space. When the pressure is desired to be maintained in said space, there is installed in connection with the material outlet, a valve or valves whereby the material can be removed from the space without essentially altering the pressure. The employed valves can be either electric, hydraulic or pneumatic, in which case the material usually causes a pressure to the valve flap. When the pressure surpasses a given limit, the valve is opened, and the material is discharged from the space. When the amount of discharged material rises to a level where the pressure caused by said material is sufficiently reduced, the valve is closed. This kind of valve can be for example an eccentric flap valve, where the pressure is located on the other side of the valve flap. However, the valve is not suited for finely divided solids, because in connection with the closing of the valve, in between the valve flap and the valve housing, there remain solid particles that reduce the compactness of the sealing achieved by the valve and finally make the valve unfit for use.

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Pneumatically sealed valves are also used for removing material from a pressurised space. A pneumatically sealed calotte valve has a uniform pneumatic sealing, but otherwise the structure corresponds in principle to a spherical valve, in which case the drawbacks are a large size and a high price. Known pneumatically sealed flap valves are in form symmetric in relation to the

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axis, in which case the drawback is their sealing at the axis. This type of valve arrangement is also easily blocked.

From the FI patent 68,977 there is known a filter device that with gearing and actuator is used in an over pressure space, and the filtering products thereof, i.e. the finely divided solids, are removed through a lock gate from the over pressure space. The employed lock gate is for instance a blade lock or a spiral conveyor, in which case the solids flow is utilised in the operation of the lock gate. Now the finely divided solids to be removed can to a certain extent be prevented from getting in between the locking member of the lock gate and the wall, because the lock gate as such does not perform a motion opposite to the circulation direction of the solids, but the solids always flow to the same direction. However, the operation of this kind of a lock gate is dependent on the solids flow, because the solids flow as such maintains the compactness achieved by means of the lock gate as the position of the blades alters, in order to maintain the over pressure in the over pressure space.

The US patent 5,362,403 specifies a filtering device and method for removing the filter cake from the filtering part of the filtering device. In said method, the filter cake is transferred by a spiral conveyor to a discharge shaft. In the bottom part of said discharge shaft, there is installed a locking member which is hydraulically controlled. According to the US patent 5,362,403, the locking member together with the discharge shaft forms a pressure lock in between the filtering device and normal air pressure. The operation of the locking member is controlled by two electrodes attached to the discharge shaft, so that when the filter cake has reached a certain height in the discharge shaft, the filter cake creates an electric lock in between the electrodes, the control member opens the locking member and the filter cake is discharged through the discharge shaft. The removal of the filter cake is thus carried out in a discontinuous way, and in connection with the removal, it is possible that the pressure is reduced in the filtering device proper, too.

The object of the present invention is to eliminate some of the drawbacks of the prior art and to achieve an improved apparatus with a simpler structure and a lower price for removing filtered material from pressurised space, said apparatus functioning automatically according to operating pressure and material flow. The essential novel features of the invention are apparent from the appended claims.

According to the invention, the conveyor transfers in a pressurised space filtered material obtained from the filter to a discharge conduit, from where the filtered material is transferred to normal air pressure via an adjusting member located at the opposite end. By means of said adjusting member, the surface height of the filtered material in the discharge conduit is maintained essentially on the same level on a substantially continuous basis. When the surface height in the discharge conduit surpasses a predetermined value, the aperture of the adjusting member is increased. Thus the flow speed of the filtered material increases, and the surface height in the discharge conduit is reduced to a desired, predetermined value. Respectively, when the surface height falls under a predetermined value, the aperture of the adjusting member is diminished in order to return the surface height to the desired, predetermined value.

In the apparatus according to the invention, the adjusting member installed in the discharge conduit includes at least two at least partially overlapping adjusting elements, which are provided with ports for letting the filtered material flow through the adjusting member. The total area of said ports falls within the range of 5 - 20 %, advantageously 10 - 15 % of the total area of the adjusting element. Moreover, in relation to each other the adjusting elements are arranged so that at least one of the adjusting elements can be moved. When the adjusting elements are moved with respect to each other, the ports provided in different elements can be matched, at least in a partly overlapping fashion, so that through said ports, the filtered material can be made to flow

from the discharge conduit to normal air pressure. Respectively, when the adjusting elements are moved in relation to each other so that the ports in the separate adjusting elements are not matched, the flowing of the filtered material is prevented.

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According to the invention, in order to move the separate adjusting elements of the adjusting member in relation to each other, at least one of the adjusting elements is connected to a moving member. Said moving member is operated pneumatically, hydraulically or electrically. Depending on the mode of operation
10 of the moving member, the adjusting member can be connected to the moving member either directly or via a separate transmission member. The employed transmission member can be for instance a lever arm or a piston, or said transmission member can be made of several parts, in which case it comprises for example a servo valve, a pneumatic cylinder and a lever arm.

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In the apparatus according to the invention, the operation of the adjusting member is controlled by a control member which measures the surface height of the filtered material in the discharge conduit. Preferably the measuring is carried out by means of a measuring sensor installed outside the discharge
20 conduit. Advantageously the measurement takes place by means of ultrasound, for instance, or then the change caused by the filtered material in the support structure of the discharge conduit is utilised in the measurement.

When using ultrasound, at least one ultrasonic sensor is employed for measuring
25 ing in an essentially continuous fashion the surface height of the filtered material contained in the discharge conduit. In the control unit of the apparatus according to the invention, the obtained result is compared with the desired, predetermined surface height value. If the measuring result differs from said predetermined value, the control unit controls the adjusting member moving
30 member, so that the surface height is returned to the desired, predetermined value.

When applying the strength change caused by the material in the supporting structure of the discharge conduit while measuring the filtered material surface height, outside the discharge conduit, in connection with the measuring sensor, there is installed at least one actuator whereby the strain caused by the filtered material in the supporting structure of the discharge conduit can be measured. Said actuator can be for example a bellows member made of some elastic material, so that on the basis of the elastic shortening of said bellows member, the change caused by the filtered material in the supporting structure of the discharge conduit can be determined. As an alternative, said actuator can be a tension-measuring member which determines the tension caused in the supporting structure by the filtered material. In the control unit of the apparatus of the invention, the obtained measuring result of the change in the support structure is compared, in the same fashion as when using ultrasound, with the predetermined supporting structure change caused by the desired surface height. On the basis of said comparison, the control unit controls the adjusting member, so that the surface height is returned to the desired value.

When using the apparatus according to the invention, by keeping the surface height of the filtered material essentially continuously on a desired, predetermined level, the filtered material serves as a pressure lock. Moreover, the filtered material and the pressure contained inside the filtering device direct a pressure force to the adjusting elements of the adjusting member, so that the adjusting elements are pressed against each other. When the surfaces of the adjusting elements that are nearest to each other are advantageously essentially smooth, the pressure force presses said adjusting elements together in an essentially compact fashion, in which case the pressure leak taking place via the adjusting member is as small as possible.

The invention is explained in more detail below, with reference to the appended drawing, wherein

figure 1 shows a preferred embodiment of the invention in a schematical side-view illustration,

figure 2 shows another preferred embodiment of the invention in a schematical side-view illustration,

5 figure 3 is a top-view illustration of an adjusting element according to the invention, and

figure 4 is a top-view illustration of an another adjusting element according to the invention.

10 According to figures 1 and 3, a conveyor 2 installed inside a pressurised filter 1 conveys material 11 filtered in a filter 1 to a discharge conduit 3. To the discharge conduit 3, to its filtered material discharge end, there is attached an adjusting member 4. The adjusting member 4 includes two concentric elements 5 and 6 which are provided with ports 7. In relation to each other, said adjusting
15 elements 5 and 6 are advantageously installed, so that one adjusting element 5 is installed permanently, whereas the other adjusting element 6 is installed movably with respect to the axis 8. In order to move the adjusting element 6, said element 6 is connected to a control unit 12 by intermediation of a lever arm 9, a pneumatic cylinder 14 and a servo valve 13.

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While the adjusting member 3 is in operation, in the immediate vicinity of the discharge conduit 3, there is installed an ultrasonic sensor 10, which measures, in an essentially continuous manner, the surface height 15 of the filtered material 11 contained in the discharge conduit. In the control unit 12 of the
25 apparatus, the measuring result obtained from the ultrasonic sensor 10 is compared with the desired, predetermined value. If the measuring result differs from the predetermined value, the control unit 12 operates a servo valve 13, which further controls the pneumatic cylinder 14 connected to the lever arm 9 in order to move the adjusting element 6 in relation to the adjusting element 5, so
30 that the surface height of the filtered material 11 in the discharge conduit 3 is returned to the desired, predetermined value.

According to figure 2, in the discharge conduit 21, there are attached shoulders 22 that support the discharge conduit 21. In between said shoulders 22 and the support surface 23, there are installed actuators 24, i.e. bellows members made of some elastic material, which members receive the changes caused by the filtered material in the pressure of the discharge conduit 21. The change received by the bellows members 24 is measured by means of a force measuring sensor 25. In the control unit 26, the measuring result given by the force measuring sensor 25 is compared with the change causing the desired, predetermined value of the surface height. If the measuring result differs from the desired value, the adjusting member 27 provided in the bottom part of the discharge conduit 21 is manipulated, so that in the discharge conduit 21, there can be maintained the desired surface height of the filtered material. Accordingly, if the surface height level 28 surpasses the desired, predetermined value, the adjusting elements 29 and 30 of the adjusting member 27, provided with ports, are moved in relation to each other, so that from the discharge conduit 21, there is discharged filtered material through the adjusting elements 29 and 30 to further processing. Said adjusting elements 29 and 30 are installed concentrically with respect to the axis 31, so that at least one of the adjusting elements 29 and 30 can be moved in relation to the axis 31. To the axis 31, there is connected a lever arm 32, whereby the adjusting element or elements 29 and 30 are moved in order to create an advantageous material flow from the discharge conduit 21 to outside it.

Figure 4 illustrates an advantageous manner for locating the ports 33 in the adjusting elements 29 and 30.

CLAIMS

1. An apparatus for removing filtered material from a pressurised filter space, in which filter space there are installed members for feeding the material to be
5 processed into filtering that takes place in a pressurised space, as well as members for removing the filtering product, i.e. the filtered material, from the pressurised filter space, **characterised** in that in the discharge conduit (3,21) of the filter space, at the material discharge end, there is connected an adjusting member (4,27), said adjusting member (4,27) comprising at least two adjusting
10 elements (5,6;29,30) which are provided with ports (7,33) and are movable in relation to each other, for maintaining the measurable surface height (11,28) of the filtered material contained in the discharge conduit (3,21) essentially at a predetermined value in a substantially continuous fashion.
- 15 2. An apparatus according to claim 1, **characterised** in that at least one of the adjusting elements (5,6;29,30) is movable.
3. An apparatus according to claim 1 or 2, **characterised** in that the adjusting elements (5,6;29,30) are installed concentrically (8,31) in relation to each other.
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4. An apparatus according to claim 3, **characterised** in that at least one of the adjusting elements (6,30) is installed movably around the axis (8,31).
5. An apparatus according to any of the preceding claims, **characterised** in
25 that in order to measure the surface height (11) of the filtered material, the discharge conduit (3) is provided with an ultrasonic sensor (10).
6. An apparatus according to any of the claims 1 - 4, **characterised** in that in order to measure the surface height (28) of the filtered material, in the
30 discharge conduit (21) there is installed an actuator that measures the changes in the discharge conduit supporting structure (22).

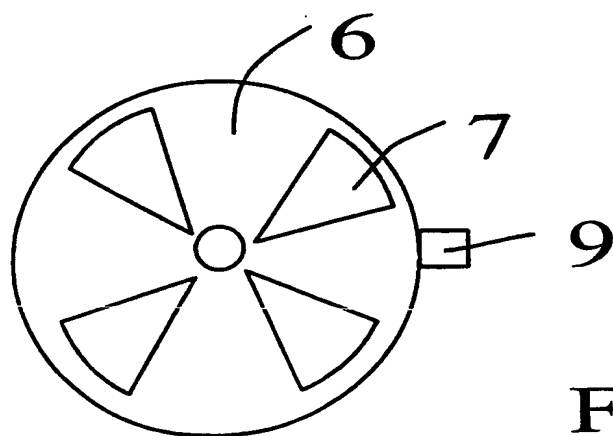
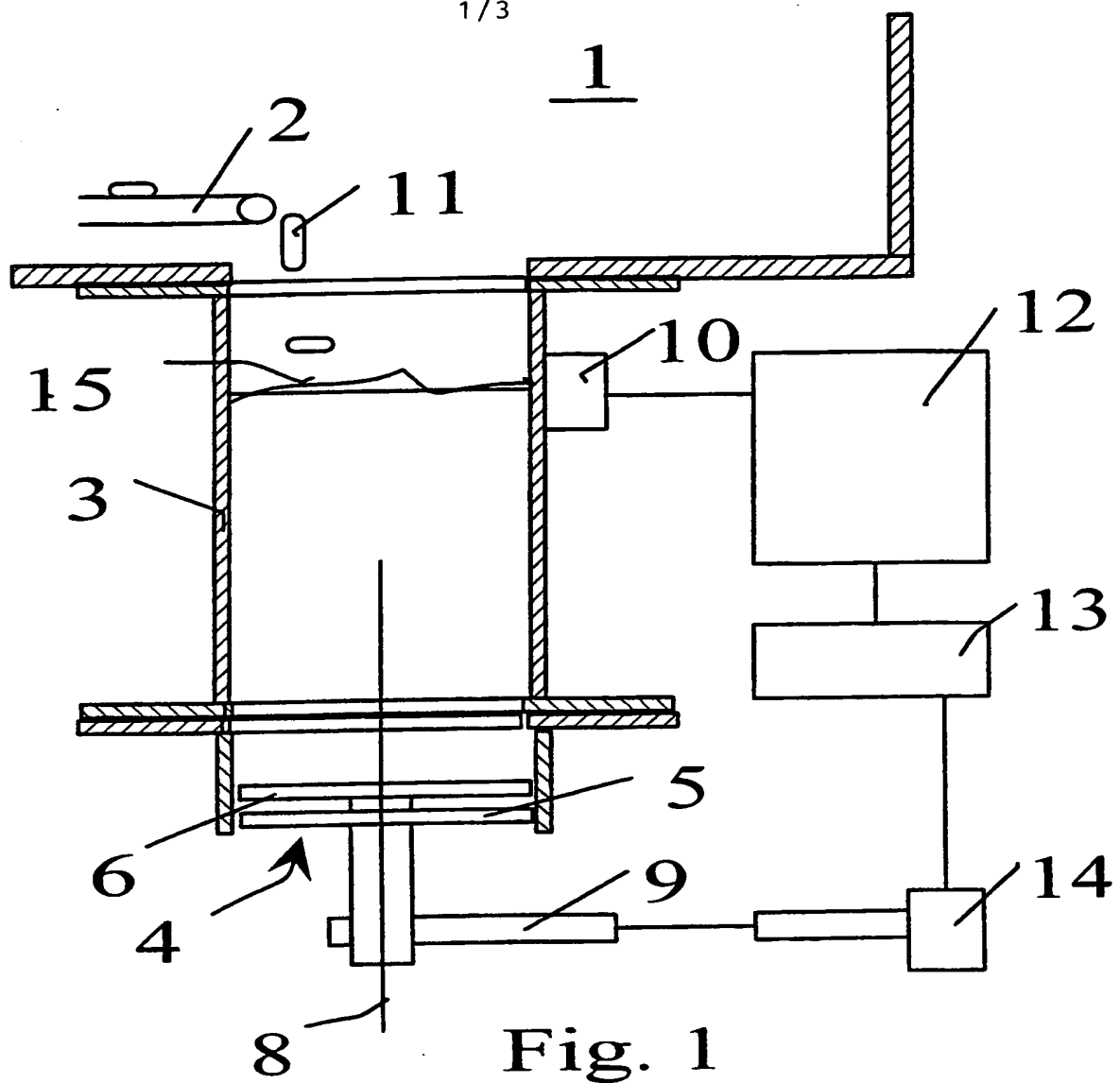
7. An apparatus according to claim 6, **characterised** in that the actuator measuring the change of the discharge conduit supporting structure (22) is a force measuring sensor (25).

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8. An apparatus according to claim 6, **characterised** in that the actuator measuring the change of the discharge conduit supporting structure (22) is a tension measuring sensor.

10 9. An apparatus according to any of the preceding claims, **characterised** in that the measuring of the filtered material surface height (10,25) and the member (15,31) for moving the adjusting element are interconnected electrically (12,26).

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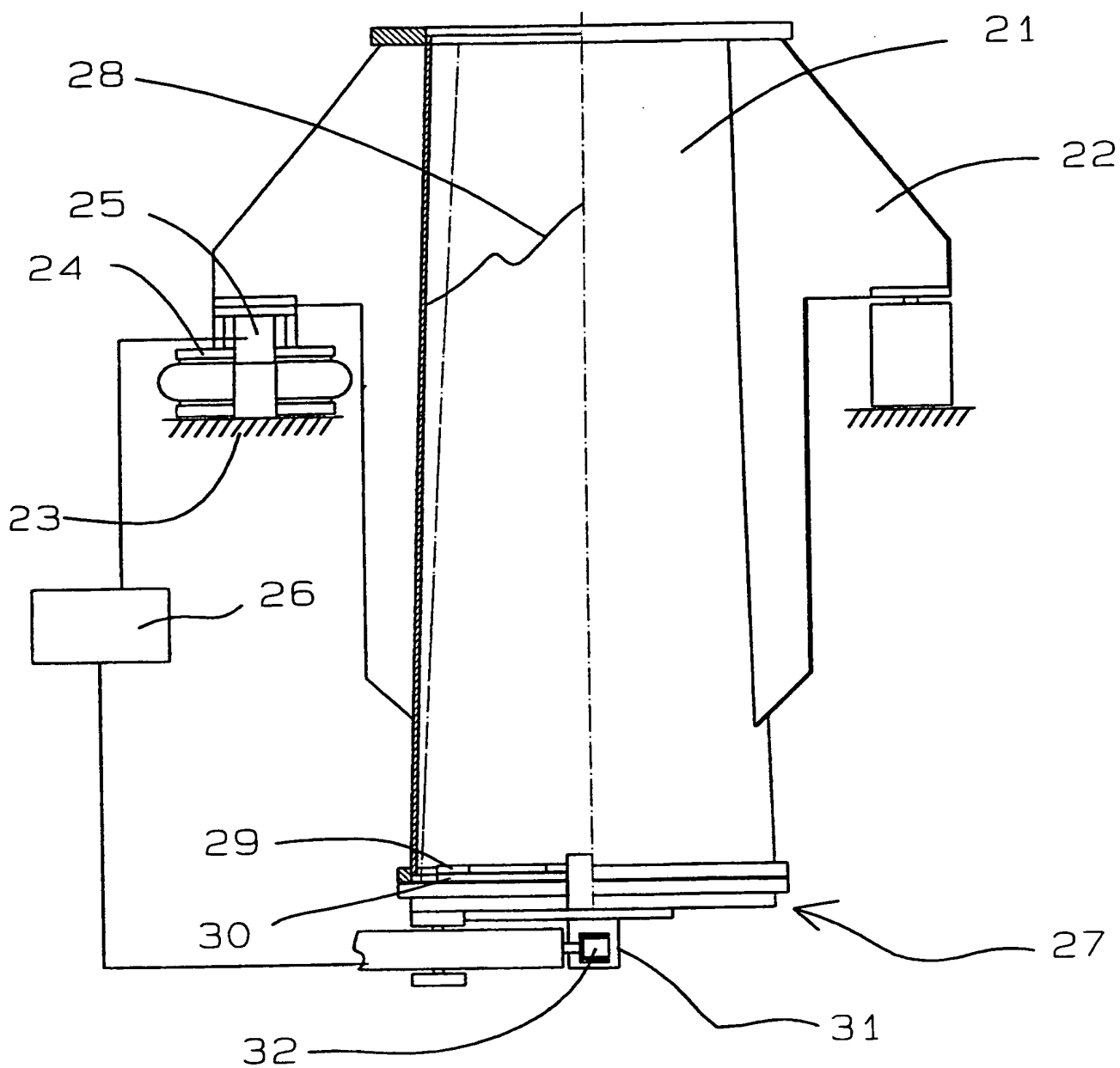


Fig. 2

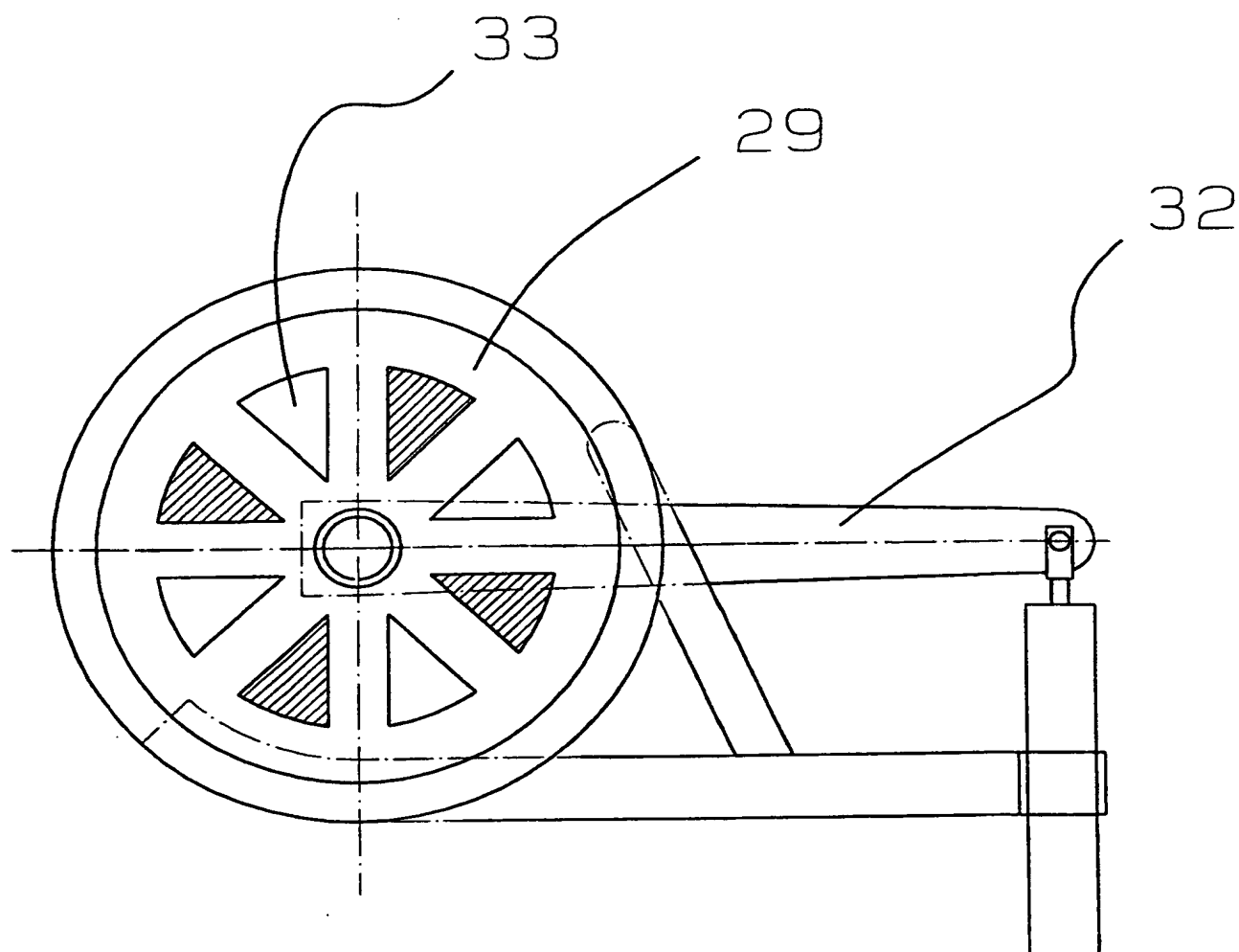


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 99/00258

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B01D 33/76

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5362403 A (MARTIN DOSOUDIL), 8 November 1994 (08.11.94) --	1-9
A	DE 4425451 A1 (KLÖCKNER-HUMBOLDT-DEUTZ AG), 25 January 1996 (25.01.96) --	1
A	US 4695381 A (SAMUEL RAGNEGARD), 22 Sept 1987 (22.09.87), figures 3,4 -----	1

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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Information on patent family members

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